

Ionic Polyimides-New High Performance Polymers for Additive Manufacturing - FY18

Completed Technology Project (2017 - 2018)



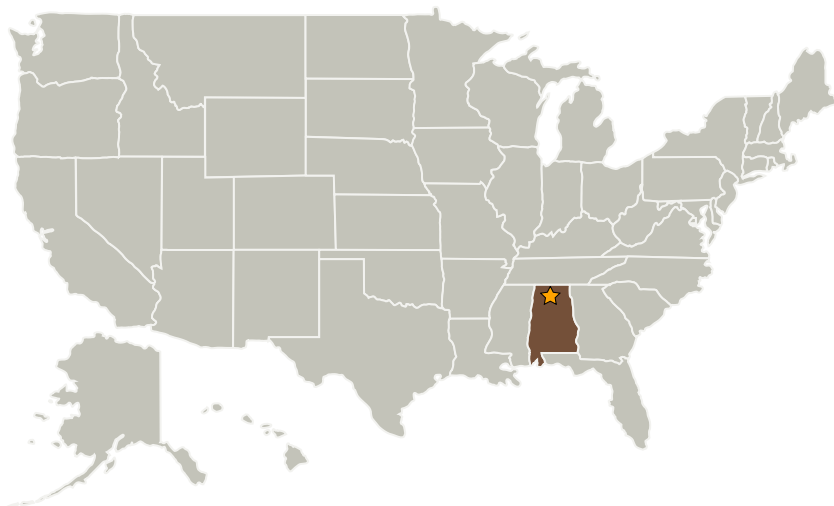
Project Introduction

The objectives of this proposal is to understand the structure-property-performance relationships underlying ionic polyimides and understand their utility as materials suitable for additive manufacturing (In-Space Manufacturing) of components of aerospace vehicles, with an emphasis on characterizing their thermal behaviors and properties. Also, this proposal addresses the need for fundamental research on a customizable polymer filament feedstock where its properties are tailorable and potentially superior to the commercial blends offered in industry today.

Anticipated Benefits

The deliverables for this project are the creation of a database that will detail the relationships between the molecular structure and physical properties for the ionic polyimide of interest (e.g. Tg/Tm relative to different ionic polyimide structures). This new database will provide a road map to the development of the first generation of materials and ultimately proof-of-concept.

Primary U.S. Work Locations and Key Partners



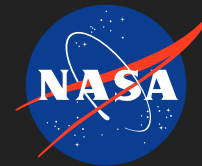
Ionic Polyimides-New High Performance Polymers for Additive Manufacturing - FY18

Table of Contents

Project Introduction	1
Anticipated Benefits	1
Primary U.S. Work Locations and Key Partners	1
Project Transitions	2
Project Website:	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Technology Areas	3
Target Destination	3

Ionic Polyimides-New High Performance Polymers for Additive Manufacturing - FY18

Completed Technology Project (2017 - 2018)



Organizations Performing Work	Role	Type	Location
★ Marshall Space Flight Center (MSFC)	Lead Organization	NASA Center	Huntsville, Alabama
The University of Alabama	Supporting Organization	Academia	Tuscaloosa, Alabama
University of Alabama in Huntsville (UAH)	Supporting Organization	Academia	Huntsville, Alabama

Primary U.S. Work Locations

Alabama

Project Transitions

▶ **October 2017:** Project Start

✓ **September 2018:** Closed out

Closeout Summary: We are continuing to synthesize different variations of the se ionic polyimides and characterize these polyimides with different thermal characterization techniques: • Differential Scanning Calorimetry (DSC) • Fourier Transform Infrared Spectroscopy (FT-IR) • Thermogravimetric Analysis (TGA) We will also continue modeling ionic polyimides via ab initio calculations. In addition to this project, we was awarded a CAN award to continue this project. Finally, we will develop filament feedstock materials from these ionic polyimides and ILs to additively manufacture parts from these materials for aerospace applications.

Project Website:

https://www.nasa.gov/directorates/spacetech/innovation_fund/index.html#.VC

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Marshall Space Flight Center (MSFC)

Responsible Program:

Center Innovation Fund: MSFC CIF

Project Management

Program Director:

Michael R Lapointe

Program Manager:

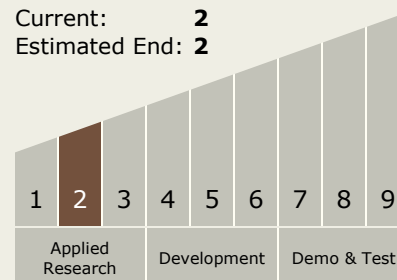
John W Dankanich

Principal Investigator:

Enrique M Jackson

Technology Maturity (TRL)

Start: 2
Current: 2
Estimated End: 2



Ionic Polyimides-New High Performance Polymers for Additive Manufacturing - FY18

Completed Technology Project (2017 - 2018)



Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
 - └ TX12.1 Materials
 - └ TX12.1.1 Lightweight Structural Materials

Target Destination

Earth